APPENDIX Q

INTERCONNECTION STUDY

Q.1 EXECUTIVE SUMMARY

The Southern California Public Power Authority (SCPPA) is considering the development of a combined cycle power plant (the "Project") at the Magnolia Generating Station in the City of Burbank (Burbank). The two plants under consideration are a Siemens Westinghouse 501F and a General Electric 7FA, each in a two-shaft configuration and with a nominal rating of 250 MW. The Project's capacity could be increased by up to 328 MW by utilizing steam injection and duct firing.

At the present time it is envisioned that the output of the Project will be utilized to serve portions of the electrical load in the Cities of Anaheim, Burbank, Colton, Glendale, and Pasadena. Glendale's share of the Project capacity could be delivered:

1. To the interconnection point between Burbank and the Los Angeles Department of Water (LADWP) at the Toluca Substation and then over LADWP 230-kV facilities to the LADWP/Glendale interconnection at the Airway Substation, or

2. Via two 69-kV lines between the Burbank and Glendale systems.

The capacity shares of the other Cities would be delivered to the Burbank/LADWP interconnection point at Toluca and from Toluca to the LADWP/Southern California Edison (Edison) interconnection points and then to the Edison/Cities interconnection points over facilities owned by Edison and under the operational control of the California ISO.

SCPPA is undertaking the licensing of the proposed Project in accordance with the California Energy Commission (CEC) Six-Month Power Plant Licensing Process as summarized in the CEC document of November 15, 2000. With respect to the potential impacts that a generating project could have on the transmission network, the CEC Process states that the application for certification for a project shall contain substantial evidence that the project would not cause a significant adverse impact on the electrical system. The evidence to be provided must consist of:

1. An Interconnection Study identifying the electrical system impacts and a discussion of the mitigation measures considered and those proposed to maintain conformance with NERC, WSCC, Cal-ISO or other applicable planning criteria, and

2. A full description of the facilities, if any, that are required for interconnection, including all such facilities beyond the point where the outlet line joins with the interconnected system.

SCPPA retained Navigant Consulting, Inc. to undertake the technical studies to provide the information required in the Interconnection Study via the following steps:

1. Develop Powerflow Base Cases
2. Perform Powerflow Contingency Analysis
3. Perform Post Transient Studies
4. Perform Transient Stability Studies
5. Perform Short Circuit Studies

Q.1.1 Summary of Results

The powerflow analysis discussed in subsequent sections of this Appendix indicate that:

1. The interconnection of a 250 MW Project with the Burbank system has no negative impacts on the Burbank system or the external systems (Glendale, LADWP, and SCE).

2. No negative impacts on the Burbank system or the external systems would occur if a 250 MW Project is developed and the Burbank-Glendale 69-kV ties were operated in a closed fashion.

3. The interconnection of a 328 MW Project with the Burbank system has no negative impacts on the external systems (Glendale, LADWP, and SCE). However, overloads (of 20%) are noted on one of the Project-Olive 69-kV lines after an outage of the other Project-Olive 69-kV line. Should the 328 MW Project configuration be developed, cables with sufficient capacity (greater than the 2,000 amps assumed in the studies) would be installed to mitigate the impact of the loss of one of the cables.

4. If the Burbank-Glendale 69-kV ties are operated in a closed fashion with a 328 MW Project on-line, overloads (of as much as 19%) are noted on the 69-kV facilities supporting the Burbank-Glendale ties for certain N-1 outages. Mitigating these overloads will be accomplished by opening the overloaded tie line via a remedial action scheme (RAS). Powerflow studies indicate that doing so would not have an adverse impact on the Burbank or Glendale systems.

The reactive margin analysis discussed in subsequent sections of this report indicated that:

1. The reactive margins at the Victorville, Toluca, and Rinaldi 500-kV busses are consistently well in excess of existing criteria.

2. The reactive margins at the Toluca and Rinaldi busses tend to improve slightly due to the addition of the Project; the greatest improvements occur with the 328 MW Project.

The post-transient voltage deviation studies performed indicate that the presence of the Project (at either 250 MW or 328 MW) does not have a negative impact on or may slightly improve post-transient voltage deviations.

Q.2 DETAILED DISCUSSION

Q.2.1 Transmission System Reliability Criteria

The studies applied, as appropriate, the transmission planning criteria and guidelines of Burbank, LADWP, Edison, as well as the reliability criteria of the California ISO. More specifically, the main criteria applied during the studies were as follows:

Q.2.1.1 Load Flow Assessment

The following contingencies were considered for transmission lines and transformer banks (as noted):

1. Single contingencies (N-1):

    a. All 12.5 kV, 13.8 kV, 34.5 kV and 69 kV lines and transformers on the COB and Glendale systems.

    b. All 230 kV and 500 kV lines and transformers on the LADWP and Edison systems.

2. Double contingencies (N-2):

    a. Credible outages of two 34.5 kV and/or 69 kV lines on the Burbank and Glendale systems.

    b. Credible outages of two 230 kV and/or 500 kV lines on the LADWP and Edison systems.

    c. Credible outages of one 230 kV or 500 kV line and one 500/230 kV transformer on the LADWP and Edison systems.

Q.2.1.2 Loading Criteria

The loading criteria applied in the studies are summarized in Table Q-1.

TABLE Q-1

TRANSMISSION LINE AND TRANSFORMER LOADING CRITERIA (All Values in % of Normal Loading Criteria)

		System			
		Burbank	**Glendale**	**LADWP**	**Edison**
Transmission Lines	Base Case (N-0)	100	100	100	100
	N-1 Contingencies	115	100	[1]	115
	N-2 Contingencies	135	100	[1]	135
Transformers	Base Case (N-0)	100	100	100	100
	Long Term (24 hours)	110	100	[1]	110
	Short Term (1 hour)	150	100	[1]	150

[1] Use "MVA2" ratings in powerflow data set.

Q.2.1.3 Post-Transient Voltage Deviation and Voltage Stability Assessments

The post-transient voltage deviation and reactive margin criteria applied during the studies are summarized in Table Q-2.

TABLE Q-2

POST-TRANSIENT VOLTAGE DEVIATION AND REACTIVE MARGIN CRITERIA

		System	
		LADWP	**Edison**
Maximum Allowable Voltage Deviations (%)	N-1 Contingencies	5	7
	N-2 Contingencies	10	10
Minimum Reactive Margin Requirements (MVAR)	N-1 Contingencies		
	230-kV	----	177
	500-kV	[1]	220
	N-2 Contingencies		
	230-kV	----	89
	500-kV	[2]	110

[1] 500 MVAR at Adelanto and Victorville
[2] 250 MVAR at Adelanto and Victorville

Q.2.1.4 Stability Assessments

The stability studies simulated system performance for a minimum of 15 seconds and will utilized the following criteria:

1. All machines in the system shall remain in synchronism as demonstrated by their relative rotor angles.

2. System stability will be evaluated based on the damping of the relative rotor angles and the damping of the voltage magnitude swings.

3. Transient voltage dips above 0.80 p.u. at Adelanto and Sylmar should be maintained.

4. Other transient voltage dips and transient frequency deviations must meet the WSCC Reliability Criteria for Performance Levels A and C (N-1 and N-2 outages).

Q.2.1.5 Congestion Assessment

The following principles were used for accommodating generation into the Edison transmission system that falls under the CA-ISO jurisdiction.

1. Enough capacity shall be maintained to accommodate all Reliability Must-Run and Regulatory Must-Take generation resources with all facilities in services.

2. Enough capacity shall be maintained to accommodate the total output of any one generator which is not classified as Reliability Must-Run.

3. The ISO protocol on congestion management shall apply when two or more generators which are not classified as Reliability Must-Run exceed the available capacity of the system.

Q.2.2 System Conditions

The initial studies assessed the five scenarios summarized in Table Q-3 for on-peak load conditions.

TABLE Q-3

SCENARIOS EVALUATED

	Scenario				
	1	**2_250**	**2_328**	**3_250**	**3_328**
Magnolia Project (MW)	0	250	328	250	328
Other Burbank Generation (MW)					
Status of Burbank-Glendale Ties	Open	Open	Open	Closed	Closed

The starting point base case (Scenario 1) for these studies was the 2005 summer peak base case prepared by Edison for use in its 2000 Transmission Assessment. This case was modified to reflect:

1. The addition of the following merchant power projects being proposed for development on the Edison system:

   a. The 750 MW Pastoria Project

   b. The 560 MW Nueva Azaleas Project (interconnected with the Mesa-Redondo 230-kV line)

   c. A 870 MW project interconnected with the Laguna Bell 230-kV Substation

   d. 740 MW of additional generation at Alamitos and at Huntington Beach

2. The addition of detailed models for the systems of the Cities of Burbank, Glendale, and Pasadena.

3. The addition of the following proposed generating facilities on the LADWP system:

   a. The 547 MW Valley Repower Project

   b. 100 MW of additional generation at Haynes

   c. 235 MW of additional generation at Harbor

   d. The 273 MW Florida Power Light Energy wind farm project interconnected with the Owens Gorge-Rinaldi 230 kV line

Two post-Project base cases ("op_scen2_250" and "op_scen2_328") were also developed to test the ability of the Burbank system to deliver the Project output to the interconnection point with LADWP under off-peak load conditions. In these cases:

1. The load on the Burbank system was equal to approximately 60% of the 330 MW level in the summer peak cases discussed above.

2. Project generation was set at 250 MW and 328 MW, respectively.

3. Existing generation at the Olive and Magnolia plants was taken off-line.

4. The Burbank-Glendale ties were open.

Q.2.3 Results of Powerflow Studies – Summer Peak Conditions – Burbank System

In assessing the potential impacts of adding the Project to the Burbank system a total of approximately 90 N-1 outages and 8 N-2 outages were simulated on the Scenarios summarized in Table Q-3. The base case (N-0) results as well as the results of the outage simulations are presented in Table Q-4 and are summarized as follows:

Q.2.3.1 N-0 Studies

1. No overloads were noted in any of the Scenarios.

2. However, in Scenario 1 the Magnolia #4 13.8-kV/Burbank 34.5-kV transformer was loaded at 97% while in Scenario 3_328 the Olive-TLOlive 69-kV line was loaded at 99% of its rated capability.

Q.2.3.2 N-1 Studies

1. Thirteen outages resulted in overloads (ranging from 8% to 68%) for Scenario 1. The highest overload noted occurred on the Magnolia #3 13.8-kV/Burbank 34.5-kV transformer as a result of an outage of the Magnolia #4 13.8-kV/Burbank 34.5-kV transformer or the Magnolia #4-Olive #3&#4 13.8-kV tie line.

2. For Scenario 2_250:

    a. Eleven outages resulted in overloads (2 of the outages that resulted in overloads in Scenario 1 did not result in any overloads on this Scenario).

b. Seven of these 11 overloads were on the same facilities and were of the same magnitude as in Scenario 1 while 4 of them were lower than those noted on a given element in Scenario 1.

3. For Scenario 2_328:

   a. Thirteen outages resulted in overloads (3 of the outages that resulted in overloads in Scenario 1 did not result in any overloads on this Scenario).

   b. Seven of these 13 overloads were on the same facilities and were of the same magnitude as in Scenario 1 while 3 of them were lower than those noted on a given element in Scenario 1.

   c. Two new overloads occurred, as follows:

      i. 20% on one of the Project-Olive 69-kV lines for an outage of the parallel line, and

      ii. 16% on the Magnolia #4-Olive #3&#4 13.8-kV tie after an outage of one of the Burbank 34.5-kV/Olive 69-kV transformers.

4. For Scenario 3_250:

   a. Eleven outages resulted in overloads (2 of the outages that resulted in overloads in Scenario 1 did not result in any overloads on this Scenario).

   b. Seven of these 11 overloads were on the same facilities and were of the same magnitude as in Scenario 1 while 4 of them were lower than those noted on a given element in Scenario 1.

5. For Scenario 3_328:

   a. Fourteen outages resulted in overloads (3 of the outages that resulted in overloads in Scenario 1 did not result in any overloads on this Scenario).

   b. Seven of these 14 overloads were on the same facilities and were of the same magnitude as in Scenario 1 while 3 of them were lower than those noted on a given element in Scenario 1. Five new overloads occurred, as follows:

      i. 19% on one of the Project-Olive 69-kV lines for an outage of the parallel line,

ii. 14% on the Magnolia #4-Olive #3&#4 13.8-kV tie after an outage of one of the Burbank 34.5-kV/Olive 69-kV transformers,

iii. 2% on the Olive-TL Olive 2 69-kV line due to an outage of the Olive-TL Olive 1 69-kV line,

iv. 19% on the Olive-TL Olive 1 69-kV line due to an outage of the Olive-TL Olive 2 69-kV line, and

v. 10% on the TL Olive 2-Western 69-kV line due to an outage of the Olive-TL Olive 1 69-kV line,

With respect to the overloads noted for Scenario 3_328:

1. Those occurring on one of the Project-Olive 69-kV tie lines for an outage of the parallel tie line would not exist if the rating of these new tie lines was increased to better match the size of the proposed generation.

2. Those on the facilities associated with the 69-kV ties to Glendale (e.g., the Olive-TL Olive 2 69-kV, the Olive-TL Olive 1 69-kV line, and the TL Olive 2-Western 69-kV line) could be mitigated by opening the overloaded tie line via a remedial action scheme (RAS). Powerflow studies indicate that doing so would not have an adverse impact on the Burbank or Glendale systems; such will be confirmed during the transient stability analysis.

Q.2.3.3 N-2 Outages

Only one of the eight N-2 outages (that of both of the Burbank 34.5-kV/Olive 69-kV transformers) resulted in overloads; as follows:

1. In Scenario 1, four overloads (ranging from 5% to 61%) were noted. The highest overload noted occurred on the Magnolia #4 13.8-kV/Burbank 34.5-kV transformer.

2. In Scenario 2_250, five overloads (ranging from 14% to 72%) were noted. The highest overload noted occurred on the Magnolia #4 13.8-kV/Burbank 34.5-kV transformer. The "new" overload (29%) occurred on the Olive #3&#4 13.8-kV/Olive 69-kV transformer.

3. In Scenario 2_328, five overloads (ranging from 18% to 103%) were noted. The highest overload noted occurred on the Magnolia #4-Olive #3&#4 13.8-kV tie and the Olive #3&#4 13.8-kV/Olive 69-kV transformer overload increased to 65%.

4. In Scenario 3_250, five overloads (ranging from 14% to 73%) were noted. The highest overload noted occurred on the overload noted occurred on the Magnolia #4 13.8-kV/Burbank 34.5-kV transformer and the Olive #3&#4 13.8-kV/Olive 69-kV transformer overload was 28%.

5. In Scenario 2_328, five overloads (ranging from 18% to 103%) were noted. The highest overload noted occurred on the Magnolia #4-Olive #3&#4 13.8-kV tie and the Olive #3&#4 13.8-kV/Olive 69-kV transformer overload was 65%.

Q.2.4 Results of Powerflow Studies – Summer Peak Conditions – External Systems

In assessing the potential impacts of adding the Project to the systems external to the Burbank system (Glendale, LADWP, and SCE) numerous N-1 and N-2 outages were simulated on these external systems. The base case (N-0) results as well as the results of the outage simulations are presented in Table Q-5 and are summarized as follows:

Q.2.4.1 City of Glendale

1. No N-0 overloads were noted in any of the Scenarios.

2. Seven of the 53 N-1 outages simulated on Scenario 1 resulted in overloads (based on the assumption that the emergency ratings of the Glendale lines and transformers were equal to the normal rating). These same outages resulted in overloads of essentially the same magnitude on the pertinent lines in Scenarios 2_250, 2_328, 3_250, and 3_328).

3. No N-2 outages were simulated on the Glendale system.

Q.2.4.2 Los Angeles Department of Water and Power

1. No N-0 overloads were noted in any of the five Scenarios.

2. Five of the 102 N-1 outages simulated on Scenario 1 resulted in overloads. However, the impacts of four of these outages could be mitigated by use of an existing RAS (dropping generation at Scattergood). These same outages resulted in overloads of essentially the same magnitude on the pertinent lines in Scenarios 2_250, 2_328, 3_250, and 3_328).

3. None of the eight N-2 outages simulated resulted in any overloads.

Q.2.4.3 Southern California Edison

1. No N-0 overloads were noted in any of the five Scenarios.

2. Four of the 87 N-1 outages simulated on Scenario 1 resulted in overloads. These same outages resulted in overloads of essentially the same magnitude on the pertinent lines in Scenarios 2_250, 2_328, 3_250, and 3_328).

3. None of the twenty-three N-2 outages simulated resulted in any overloads.

Q.2.5 Results of Powerflow Studies – Off-Peak Conditions – Burbank System

The off-peak studies assessing the potential impacts of adding the Project to the Burbank system consisted of simulating a total of approximately 90 N-1 outages and 8 N-2 outages on the two off-peak cases discussed above. These studies showed that:

1. No overloads would occur for N-0, N-1, or N-2 conditions when Project generation was at 250 MW.

2. When Project generation was at 328 MW, the only overloads that occurred were approximately 18% on one of the Project-Olive 69-kV lines for an outage of the parallel line.

Q.2.6 Results of Reactive Margin and Post-Transient Voltage Deviation Studies

The impacts which the addition of the Project would have on reactive margins in the Project area were assessed via Q-V analysis of eighteen critical 500-kV and 230-kV N-1 outages on the LADWP system. The results of these studies are summarized in Table Q-5. Review of the information in Table Q-5 shows that:

1. The reactive margins at the Victorville, Toluca, and Rinaldi 500-kV busses are consistently well in excess of the criteria in Table Q-2.

2. The reactive margins at the Toluca and Rinaldi busses tend to improve slightly due to the addition of the Project; the greatest improvements occur with the 328 MW Project. For example, for an outage of the Adelanto-Toluca line, the margin at Toluca would increase from 996 MVAR in Scenario 1 to 1,134 MVAR in Scenario 2-328.

Studies indicate that the presence of the Project (at either 250 MW or 328 MW) does not have a negative impact on or may slightly improve post-transient voltage deviations. For example, for an outage of the Adelanto-Toluca 500-kV line, the post transient voltage deviation at the Van Nuys 230-kV bus ranges from 2.4% in Scenario 1 to 2.3% in Scenario 2_250 to 2.4% in Scenario 3_328.

TABLE Q-4
SUMMARY OF POWERFLOW STUDY RESULTS - BURBANK SYSTEM
SUMMER PEAK LOAD CONDITIONS

		Scenario				
		1	2_250	2_328	3_250	3_328
	Existing Burbank Generation (MW)					
	Magnolia 4	10	10	0	10	0
	Magnolia 5	20	15	10	15	10
	Olive 1 & 2	50	0	0	0	0
	Olive 3 & 4	35	15	10	15	10
	Total	115	40	20	40	20
	Magnolia Project (MW)	0	250	250	250	250
	Existing Glendale Generation (MW)	145	110	100	110	100
	Status of Burbank-Glendale Ties	Open	Open	Open	Closed	Open
	LADWP-Burbank Tie Flows (MW)	220	47	(9)	119	88
	LADWP-Glendale Tie Flows (MW)	172	207	217	135	121
	SCE-Pasadena Tie Flows (MW)	82	92	92	92	92
	Burbank-Glendale Tie Flows (MW)	n/a	n/a	n/a	72	97
Conditions	**Impacted Element(s)**	**Loading (%)**				
N-0	Magnolia #4 13.8-kV/Burbank 34.5-kV	97				
	Magnolia #4-Olive #3&4 13.8-kV tie	91		95		94
	Olive-TLOlive 1 69-kV line					99
N-1 Outages (90 Simulated) [1/]						
Magnolia #4 - Olive #3 & #4 13.8-kV tie or	Olive #3&4 - Magnolia 3 13.8-kV tie	143	122	119	120	118
Magnolia #4 13.8-Burbank 34.5-kV transf.	Magnolia #3 13.8 - Burbank 34.5-kV transf.	162				
Lincoln-Golden State #1 69-kV line	Golden State #2 69/12.5-kV #1	115	115	115	115	115
Lincoln-Golden State #2 69-kV line	Golden State #1 69/12.5-kV #1	118	119	119	119	119
Magnolia #3 - Olive #3 & #4 13.8-kV tie or	Olive #3&4 - Magnolia 4 13.8-kV tie	128	105	120	106	119
Magnolia #3 13.8-Burbank 34.5-kV transf.	Magnolia #4 13.8-Burbank 34.5-kV transf.	135	120	102	119	102
One Magnolia CC-Olive 69-kV line	Other Magnolia CC-Olive 69-kV line	n/a		120		119
TL Olive1-Olive 69-kV line	TL Olive2-Olive 69-kV line					102
TL Olive2-Olive 69-kV line	TL Olive1-Olive 69-kV line					119
TL Olive2-Western 69-kV line	TL Olive1-Olive 69-kV line					110
One Burbank 34.5-Olive 69 69-kV trans.	Magnolia #4 13.8-kV/Burbank 34.5-kV	112	106		106	
	Other Burbank 34.5-Olive 69 69-kV trans.			98		
	Magnolia #4 - Olive #3 & #4 13.8-kV tie			116		114
Golden State 1 69/12.5-kV #1	Golden State #2 69/12.5-kV	118	118	118	118	118
Golden State 2 69/12.5-kV #1	Golden State #1 69/12.5-kV	118	119	119	118	118
Magnolia #5 13.8-kV/Burbank 34.5-kV	Magnolia #4 13.8-kV/Burbank 34.5-kV	108				
One San Jose 34.5-kV/12.5-kV	Other San Jose 34.5-kV/12.5-kV	143	143	145	143	144
One Hollywood Way 34.5-kV/ 12.5-kV	Other Hollywood Way 34.5-kV/ 12.5-kV	118	118	118	118	118
One Keystone 34.5-kV/12.5-kV	Other Keystone 34.5-kV/12.5-kV	152	153	153	153	153
N-2 Outages (8 Simulated) [2/]						
Burbank 34.5-Olive 69 69-kV#1 & #2 trans.	Magnolia #4 13.8-kV/Burbank 34.5-kV	161	172	170	173	171
	Magnolia #4 - Olive #3 & #4 13.8-kV	146	158	203	158	203
	Magnolia #3 13.8-kV/Burbank 34.5-kV	138	147	149	148	149
	Magnolia #3 - Olive #3 & #4 13.8-kV	105	114	118	114	118
	Olive 69-kV/Olive #3 & #4 13.8-kV		129	165	128	165

[1/] Line ratings = 115% of normal rating; transformer ratings = 100% of normal rating

[2/] Line ratings = 135% of normal rating; transformer ratings = 100% of normal rating

TABLE Q-5
SUMMARY OF POWERFLOW STUDY RESULTS - EXTERNAL SYSTEMS
SUMMER PEAK LOAD CONDITIONS

		Scenario				
		1	2_250	2_328	3_250	3_328
	Existing Burbank Generation (MW)					
	Magnolia 4	10	10	0	10	0
	Magnolia 5	20	15	10	15	10
	Olive 1 & 2	50	0	0	0	0
	Olive 3 & 4	35	15	10	15	10
	Total	115	40	20	40	20
	Magnolia Project (MW)	0	250	328	250	328
	Existing Glendale Generation (MW)	145	110	100	110	100
	Status of Burbank-Glendale Ties	Open	Open	Open	Closed	Closed
	LADWP-Burbank Tie Flows (MW)	220	47	(9)	119	88
	LADWP-Glendale Tie Flows (MW)	172	207	217	135	121
	SCE-Pasadena Tie Flows (MW)	82	92	92	92	92
	Burbank-Glendale Tie Flows (MW)	n/a	n/a	n/a	72	97
Conditions	**Impacted Element(s)**	**Loading (%)**				
Glendale System						
N-1 Outages (53 Simulated) [1/]						
Rossmoyn-Kellog 69-kV #37	Rossmoyn-Kellog 69-kV #45	134	134	134	132	132
Rossmoyn-Kellog 69-kV #45	Rossmoyn-Kellog 69-kV #37	134	134	134	132	132
Glendale-Howard 34.5-kV #12	Glendale-Howard 34.5-kV #11	129	129	129	129	129
Rossmoyn 69/34.5-kV Transformer	Tropico-Scholl 34.5-kV	121	121	121	121	121
Rossmoyn-Scholl 34.5-kV #19	Rossmoyn-Scholl 34.5-kV #20	120	120	120	120	120
Rossmoyn-Scholl 34.5-kV #20	Rossmoyn-Scholl 34.5-kV #19	120	120	120	120	120
Glendale-Howard 34.5-kV #11	Glendale-Howard 34.5-kV #12	115	114	114	114	114
LADWP System						
N-0	JWBCYN-Rinaldi 230-kV	94	94	94	94	94
N-1 Outages (102 Simulated) [2/ 3/]						
Scatergd 230/138-kV Transformer	Scatergd-Olympic 230-kV	132	132	132	132	132
Airport-Scatergd 230-kV #2	Airport-Scatergd 230-kV #1	118	117	117	117	117
Airport-Scatergd 230-kV #1	Airport-Scatergd 230-kV #2	118	117	117	117	117
Scatergd-Olympic 230-kV	Airport-Scatergd 230-kV #1 and #2	109	109	109	109	109
Hollywd-Toluca 230-kV	Hollywdnw-Toluca 230-kV	100	101	101	100	101
N-2 Outages (8 Simulated) [2/]		No Overloads Noted				
SCE System						
N-1 Outages (87 Simulated) [4/]						
Elsegundo-Chevmain 230-kV	Elsegundo-El Nido 230-kV	112	112	112	112	112
Bailey-Pastoria 230-kV	Pardee-Pastoria 230-kV	108	108	108	108	108
Elsegundo-El Nido 230-kV	El Nido-Chevmain 230-kV	101	101	101	101	101
Pardee-Bailey 230-kV	Pardee-Pastoria 230-kV	105	105	105	105	104
N-2 Outages (23 Simulated)		No Overloads Noted				

[1/] Line rating and transformer ratings = 100% of normal rating

[2/] Line ratings = "MVA2" rating in data files; transformer ratings = 100% of normal rating

[3/] Impacts of outages on Airport/Olympic/Scattergood elements can be mitigated by use of existing RAS

[4/] Line ratings = 135% of normal rating; transformer ratings = 100% of normal rating

TABLE Q-6
SUMMARY OF REACTIVE MARGIN STUDIES- LADWP OUTAGES SYSTEMS
SUMMER PEAK LOAD CONDITIONS

		Scenario				
		1	2_250	2_328	3_250	3_328
	Existing Burbank Generation (MW)					
	Magnolia 4	10	10	0	10	0
	Magnolia 5	20	15	10	15	10
	Olive 1 & 2	50	0	0	0	0
	Olive 3 & 4	35	15	10	15	10
	Total	115	40	20	40	20
	Magnolia Project (MW)	0	250	328	250	328
	Existing Glendale Generation (MW)	145	110	100	110	100
	Status of Burbank-Glendale Ties	Open	Open	Open	Closed	Closed
	LADWP-Burbank Tie Flows (MW)	220	47	(9)	119	88
	LADWP-Glendale Tie Flows (MW)	172	207	217	135	121
	SCE-Pasadena Tie Flows (MW)	82	92	92	92	92
	Burbank-Glendale Tie Flows (MW)	n/a	n/a	n/a	72	97
Outage	**Monitored Bus (500-kV)**	**Reactive Margin (MVAR)**				
Adelanto-Toluca 500-kV line and	Toluca	996	982	1,134	1,028	1,056
Toluca 500/230-kV transformers	Rinaldi	1,997	1,987	2,042	2,002	2,049
Adelanto-Victorville 500-kV line	Toluca	1,827	1,863	1,867	1,910	1,917
	Rinaldi	2,293	2,350	2,361	2,361	2,381
Castaic-Olive 230-kV line	Toluca	1,779	1,819	1,825	1,863	1,873
	Rinaldi	2,228	2,265	2,283	2,279	2,297
Castaic-Northridge 230-kV line	Toluca	1,768	1,794	1,800	1,839	1,853
	Rinaldi	2,207	2,224	2,251	2,246	2,261
Castaic-Sylmar 230-kV line	Toluca	1,769	1,809	1,815	1,846	1,861
	Rinaldi	2,209	2,248	2,266	2,261	2,279
Glendale-Atwater 230-kV line	Toluca	1,861	1,910	1,898	1,938	1,944
	Rinaldi	2,301	2,357	2,377	2,363	2,391
Olive-Northridge 230-kV line	Toluca	1,746	1,775	1,779	1,816	1,829
	Rinaldi	2,194	2,204	2,233	2,234	2,229
Rinaldi-Toluca 230-kV line	Toluca	1,569	1,656	1,628	1,657	1,673
	Rinaldi	2,268	2,317	2,334	2,329	2,345
Rinaldi-Northridge 230-kV line	Toluca	1,857	1,892	1,896	1,940	1,947
	Rinaldi	2,313	2,345	2,365	2,357	2,383
Rinaldi-Sylmar 230-kV line	Toluca	1,853	1,879	1,890	1,925	1,933
	Rinaldi	2,287	2,336	2,360	2,340	2,366
Rinaldi-Valley 230-kV line	Toluca	1,866	1,902	1,939	1,949	1,956
	Rinaldi	2,315	2,347	2,364	2,366	2,379
Century-Victorville 287-kV line	Toluca	1,809	1,846	1,853	1,893	1,949
	Rinaldi	2,291	2,326	2,348	2,347	2,361
Toluca-Atwater #2 230-kV line	Toluca	1,865	1,899	1,901	1,950	1,957
	Rinaldi	2,300	2,353	2,378	2,351	2,385
Toluca-Van Nuys 230-kV line	Toluca	1,820	1,856	1,860	1,904	1,910
	Rinaldi	2,292	2,322	2,346	2,347	2,360
Hollywood-Toluca 230-kV line	Toluca	1,842	1,877	1,892	1,925	1,932
	Rinaldi	2,301	2,335	2,355	2,356	2,369

TABLE Q-6
SUMMARY OF REACTIVE MARGIN STUDIES- LADWP OUTAGES SYSTEMS
SUMMER PEAK LOAD CONDITIONS

		Scenario				
		1	2_250	2_328	3_250	3_328
	Existing Burbank Generation (MW)					
	Magnolia 4	10	10	0	10	0
	Magnolia 5	20	15	10	15	10
	Olive 1 & 2	50	0	0	0	0
	Olive 3 & 4	35	15	10	15	10
	Total	115	40	20	40	20
	Magnolia Project (MW)	0	250	328	250	328
	Existing Glendale Generation (MW)	145	110	100	110	100
	Status of Burbank-Glendale Ties	Open	Open	Open	Closed	Closed
	LADWP-Burbank Tie Flows (MW)	220	47	(9)	119	88
	LADWP-Glendale Tie Flows (MW)	172	207	217	135	121
	SCE-Pasadena Tie Flows (MW)	82	92	92	92	92
	Burbank-Glendale Tie Flows (MW)	n/a	n/a	n/a	72	97
Outage	**Monitored Bus (500-kV)**	**Reactive Margin (MVAR)**				
Northridge-Tarzana 230-kV line	Toluca	1,856	1,892	1,896	1,939	1,947
	Rinaldi	2,297	2,346	2,373	2,366	2,386
Sylmar-Northridge 230-kV line	Toluca	1,850	1,885	1,890	1,933	1,956
	Rinaldi	2,291	2,329	2,357	2,356	2,370
Valley-Toluca 230-kV line	Toluca	1,814	1,859	1,850	1,906	1,910
	Rinaldi	2,300	2,341	2,352	2,353	2,366